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or physical change, but this is out of the question when each nostril receives a single odor, when the phenomenon is no less to be observed. By the adoption of porous earthenware cylinders in his olfactometer, Zwaardemaker is enabled to make tests with any odorous solution of definite dilution and most important of all to make them with chemical substances of known formulæ. It is to be hoped that the author will continue his studies in this interesting and, until his investigations and those of Aronsohn, rather unsuccessfully worked field. The 21 persons (furnishing 34 normal nostrils) is 1.5 degrees on the olfactometer (i. e., they could just perceive the odor furnished by the inside surface of a vulcanized rubber tube of 8 mms. bore when 1.5 cm. were exposed). The figure occurring most frequently, however, was 0.7 degrees; and Zwaardemaker's own *minimum* is 1.0. The figures for the cases examined, as also those for some visual tests made by the author, appear in the original.

Compensation von Gerüchen mittelst des Doppelriechmessers, Zwaardemaker.—Fortschritte der Medicin, 1889 Vol. VII. 721.

By use of his simple olfactometer the author has been enabled to verify, amplify and give numerical exactness to the empirical observation of perfumers, physicians and others that certain odors do not blend but neutralize each other. In this way the odor of vulcanized rubber may neutralize the odor of cedar wood, gum benzoin, paraffine wax, balsam tolu, and in turn be neutralized by any one of them if the odors are rightly graded in intensity; if the right proportion is not observed either one or the other prevails.

SPACE, TIME.

LIPPS, *Die Raumanschauung und die Augenbewegung*, Zeitschrift für Psych. u. Phys. der Sinnesorgane, 1892 III.

This is mainly a criticism of "eye-movement" theory, from the standpoint taken in other writings of the author. Lipps insists on the distinction between what is really seen and what is inferred, be the "seeing" normal or abnormal. Such optical illusions as the apparent inequality of distances and of line lengths are simply a result of our comparison—a matter of judgment. Eye-movements help us to form our space-consciousness by giving clearness and certainty to perception. Furthermore, if we regard the field of vision as a section of the larger space-world, which we survey by moving our eyes or turning our head, we may say that the position (and change of position) of the visual field is measured by such movements, without admitting that the relative position of points in that field is affected.

We do not *see* distance; we *judge* one object to be more or less remote than another. In this, as in other sense-perceptions, we *believe* that we perceive something, which in reality we do not perceive. The *form* of our visual field is likewise the outcome of judgment. The inference, not of our original, but of our developed space-consciousness, is based on eye-movements, and especially upon convergence-sensations. The original field of vision is no more a hollow sphere than it is a plane; in fact, for monocular vision there is no such thing as a spherical field. The "Blickpunkt," which is supposed to sweep round in immense circles, is an abstraction. The points successively fixated range themselves in circles because of the dome-shape of the visual field—a shape given it by experience, inasmuch as we perceive no difference in those sensations of convergence, which have come to be distance signs, and therefore regard the objects to which they correspond as equally distant from us.

The consciousness that objects are at *different* distances from us tends to correct our perception of their size. Hence, a conflict between per-

ception and the after-estimate. If the claim of the former could not be repressed, our field of vision would really be spherical; as it is, the *fiction* of such a form is harmless, provided it be not mistaken for reality. The probability of completely setting aside the evidence of perception decreases when the contrast between it and the correction urged by experience is too broad, or when the motives for such correction are not forcible enough. In the latter case, the convergence-sensations are not definite, or are not closely connected with the consciousness of size and distance. The influence of these conditions suffices to explain certain optical illusions without bringing in the eye-movement theory. To our indirect vision, a slanting line seems vertical, because our indefinite consciousness of its position does not force us to correct the perception, i. e., to lengthen in thought the distance of its farther end. The apparent curvature of straight lines is easily understood when we remember that straightness is not given in perception, but is a subjective product, and that the distance-relations out of which it grows are liable to vary with the changing effect of convergence-sensations. When these sensations correspond to the main point of regard, the curvature is less marked, because they indicate with special clearness the position and distance of the points in the line. When they have been trained by experience, as in the case of short distances, they yield an immediate impression of true distance and real magnitude; but when such experience is lacking, as it must be for greater distances and very acute angles, their worth, as distance signs, is merely analogical.

If we fixate the middle-point of a straight line, without regard to any point outside, the contradiction between perception and reality is less striking; the naturally favored straightness asserts itself; there is scarce an appearance of curvature. The illusion is more striking when we view the line with reference to a point outside, because the contradiction is greater. Observation of lines that seem to bear towards the eye, concavely or convexly, shows that the chief point of regard and our "spatial middle-point" *may* coincide, but not that they necessarily do so. Our consciousness of curvature is therefore variable, and is conditioned, not by the laws of eye-movement, but by our own mode of apprehension. The same holds good of our space-estimate and its results. The ground seems to rise towards the horizon, not because we raise our eyes, but because we underrate the distance of remotest points. The right eye undermeasures a line on the left, and vice-versa, because owing to the acuteness of the angle, we undervalue the distance differences between the line and the remoter eye. In binocular vision, the nearer eye guides our estimate according to the principle of "habitual average valuation," and the judgment thus formed affects monocular vision. The same principle accounts for errors in measuring vertical distances, and for the over-estimate of horizontal distances on the left as compared with those on the right.

E. PACE.

DE MEMME, *L'ipotesi degli spazi a n dimensioni in rapporto con la psicologia e la gnoseologia*, Riv. di filos. scient. 1891 (2) X. 688.

On the principle that geometry of n dimensions is merely algebra written in metaphor, De Memme criticises the hypothesis of Helmholtz and its application, by De Saussure, to physical and chemical problems.

FALK, *Versuche über die Raumschätzung mit Hilfe von Armkenneungenen*. Inaug. Diss., Dorpat, 1890, p. 58.

Falk studied the absolute and relative error in judging space distances by a movement of the forearm. The forearm was supported from elbow to finger-tip in a convenient carriage moving along a slide; this carriage